4. ACTIONS DURING HIGH WATER EVENTS

This chapter provides sample framework that you could use as a starting point as you develop your community's flood response plan, as described in Chapter 3. The chapter outlines many of the steps that are recommended immediately before, during, and after high water events. Not everything that's included here will be applicable in all situations, and there's a lot of important information you may find necessary to add. Building on the material presented, a flood response plan should be developed that would identify and prioritize the given activities, identify locations along your FCW which would require attention, go into more specific details as to how the tasks should be completed, and specify who within your community would be responsible for them. Additional details on some of the steps listed (for example, how to raise a levee) are presented in Appendix D.

The response activities listed below have been broken up into two phases. Phase I activities include the preliminary response activities that should be completed before the river rises to its bank full stage. By the time the river reaches its bank full stage, everything should be ready, and all necessary personnel should be prepared to respond to the flood. Phase II activities include the things that should take place once the river has risen to some gage-height beyond bank full, which is something should be decided ahead of time. With some rivers, it's possible to specify a river gage level that would indicate when the activities should expand from Phase I to Phase II. Other rivers rise more quickly, and the expansion of response activities depends more on the developing situation than on a predetermined gage height. In developing your flood response plan, consider the characteristics of all adjacent rivers and streams. Flashing streams and rivers require rapid response, while moderately rising streams or rivers allow greater reaction and warning time. It's essential that your flood fighting activities are based on the available time.

4.1 Phase I: Preliminary Response Activities

a. Public Sponsor Duties

Upon receipt of official information forecasting imminent high water, the levee district should immediately alert all project personnel concerned in flood fighting operations, mobilizing a skeleton organization capable of quick expansion. If the public sponsor is responsible for many miles of a levee system, definite sections of the levee should be assigned to individual section leaders/ supervisors. Additionally during Phase I, the sponsor should:

i. Review emergency plans and past lessons learned; identify problem areas.
ii. Verify that personnel have access to the gate keys, current rosters, a listing of project features and closings, plans, and other critical items.
iii. Coordinate efforts with communities upstream and downstream of you.
iv. There may be isolated gates or valves on private property, and the owners may need to be alerted to take action.

v. Alert the community to the potential of flooding. This will give them advance warning to take action to minimize potential damage to their business or home.
vi. Keep local/state Emergency Operations Center informed of the situation.
vii. Begin documenting the situation; send situation reports to the local or state EOC and to the Army Corps of Engineers as necessary. (It's not necessary to send reports to the Corps every time there's high water; only during unusual situations or when there's the potential for significant damage or overtopping.)

b. Initial Project Inspection

As soon as they've been notified that high water is expected, section leaders/ superiors should immediately make a thorough inspection of their section of the levee, omitting nothing from this inspection based on adequate performance during past high water events. In addition to the items that are typically inspected during patrols (which are listed in part c, below), special attention needs to be given to the following items during this initial inspection. (Note that several of these items can and should be accomplished annually and not wait for a high water prediction.)

i. Section Limits: Ensure that the dividing line between sections/section leaders are clearly defined and marked, if necessary.
ii. Condition of any recent repairs to the levee.
iii. Water conditions and any accumulation of trash, debris, ice, etc.
iv. Transportation Facilities: roads, rail, and water access.
v. Material Supply: Identify location, quantity, and conditions of all necessary tools and materials (sacks, sandbags, lumber, lights, etc.) and distribute and store them at points where maintenance is anticipated.
vi. Communications: Locate and check all two-way radios and telephones.
vii. Drainage Structures: Most drainage structures are situated to convey interior drainage from low points of the protected area through the levee by gravity flow. Because of the location, drainage structures are generally subject to inundation at lower stages than most other project features, and special attention needs to be given to flap gates and other drainage structures that might not be accessible later. (See section d, below, for maintenance during high water.)

c. Patrols

To minimize damage and to prevent the FCW from failing, any problems must be detected early and treated appropriately. The entire FCW should be patrolled at least once a day during the Phase 1 response and continually during Phase II. Patrols should be conducted by teams, rather than by individuals. Many of the tasks typically accomplished during high water inspections and patrols are listed below. Any significant or unusual conditions identified should be reported to the Army Corps of Engineers. The following section lists some typical responsibilities of patrols.

i. Patrol Responsibilities:

General items

- Record gage readings. (hourly)
- Inspect fences on the riverside of the levee frequently to make sure they are free from debris. If debris does collect along the fence, it must be cleared immediately or the fence must be cut to free the debris and decrease the possibility of damage to the levee.
- Verify that all necessary access roads and ramps along the levee are usable or will be satisfactorily conditioned.
- Take photographs of all significant issues. (Use date/time stamp on your camera when possible)

Levees

- Look for sandboils or unusual wet areas landward of the landside toe.
- Look for slides or soughs in levee side slopes.
- Look for wave wash or scouring of the riverside levee slope.
- Look for low areas in levee crown.
- Monitor relief wells (flowing/non-flowing).
- Check flap/sluice gates for proper closure.
- Check gap closures (stoplog/ sandbag, etc.).

Floodwalls

- Look for saturated areas or sandboils landward of the floodwall.
- Look for settlement (movement) of the floodwall.
- Look for bank caving which may affect the structural stability of the floodwall.
- Inspect toe drain risers (discharging/non-discharging).
- Inspect the landside of floodwall for any leakage, especially around the monolith joints.
- Inspect for wet areas, soft areas, seeps, and sink holes landward of the toe of the floodwall.
- Check gap closures (stoplog/ sandbag, etc.).

Pump Stations

- Verify proper ventilation (fans on, vents open, etc.) of the pumping plant, to prevent overheating of pump motors.
- Look for sink holes or wet areas around the perimeter of the pumping plant, and/or settlement of the pump house, all of which could potentially be the result of separation in the conduits. If this condition is suspected, the pumps and motors should be shut down until an engineering review can be conducted to analyze the condition.
- Verify that assigned operators are on duty 24 hours daily.

ii. Equipment for Patrols

- Portable radio or cell phone
- Watch
- Log book
- Patrolling instructions
- Plan of action for patrolling
- Plans of flood control project
- Operation and Maintenance Manual for the project
- Weather gear
- Flashlights
- Record Log
- Life Jackets
- Probing rod
- Short wooden stakes
- 40 feet of ½ inch nylon safety line to connect team members
- Camera

iii. Safety/Security Precautions

The members of the patrol team should walk side by side with one person on the water side of the levee near the water surface, one at the top of the levee, and one on the land side toe of the levee. The team should move slowly enough to enable the member closest to the water to probe below the surface with a rod, to discover any erosion that may be taking place. The person closest to the water should be wearing a safety line.

The person walking closest to the water should be especially observant of floating objects. The limbs and roots of a floating tree that has been uprooted can extend above the water surface and strike anyone walking along the water's edge. To increase the chance of seeing floating objects, it's best to walk upstream when patrolling the water side of the levee.

When patrolling floodwalls, the patrol should not attempt to walk the top of the wall, but should concentrate on potential problem areas on the land side (inside) of the wall. Where the wall is more than five feet above the land side ground level, it is recommended that observation points be selected every 100 yards or so, and ladders used to observe the water side of the floodwall.

Each person on the patrol should be thoroughly familiar with the community evacuation plan and signals. If evacuation is necessary, the patrolling organization should move to a predetermined location and keep the team intact.
If evacuated, when returning to the levees and floodwalls, physical conditions may be considerably different from those observed prior to the evacuation, especially if

the levee was overtopped. If overtopping occurs during the darkness, it's recommended that the patrols not be resumed until daylight, though there may be cases where this recommendation can't be followed.

Patrols should also keep an eye out for anyone that seems out of place, or who is doing something that looks doubtful. There are unfortunately some people, terrorists or otherwise, that would try to take advantage the already dangerous situations on levees or floodwalls for their own purposes. Any suspicious activities observed by the patrol should be reported immediately to the local law enforcement agency.

iv. Interaction with the public

The patrol team may see observers on the levees or at floodwalls. If there are many observers, it is recommended that an additional person be assigned to each patrol team. This additional person will act as a safety officer, explaining the dangers that are present. The patrol team is not responsible to order observers off the levees and floodwalls.

It is recommended that each team carry and pass out instruction cards describing the community evacuation plan. It is important to pass out information, so the observers are aware of the danger.

d. Phase 1 General Maintenance Activities

Once the initial inspection has been completed, each section leader should organize his labor force to take care of any pressing maintenance issues, before the river rises further. Emergency maintenance activities are no substitute for normal annual maintenance, and many of the activities listed here should not wait until high water.

i. Because of their location, drainage structures are generally subject to inundation at lower stages than most other features of the flood control project, and any maintenance problems need to be identified and corrected as quickly as possible before the water rises. Manually check all flap gates that are critical or in questionable repair, and maintain as needed. Sluice gates should be inspected before the outlet end of the structure becomes submerged, and any trash, debris, or other potential obstruction present should be removed. If, for any reason, the gate system on a drainage structure fails to operate and cannot be repaired because of high water, immediate consideration should be given to blocking the structure opening by other means. If stream stages permit, the outlet end of the structure should be blocked using timber, metal plates, tarps, sandbags, or by other means. If the efforts to plug the outlet structure fail, immediate action should be taken to build a sandbag or earth ring around the inlet structure. While the primary concern in blocking the structures is to prevent high stages of the river from

flowing into the protected area, emergency closures should be such that they can be readily removed after the river recedes.

ii. Immediate attention should be given to the grade line of each levee section or profile by comparison of existing grades with those shown in "As Built" record drawings. Fill any holes, gullies, and washes in the levee crown, embankments, and landside berms with compacted fill material if possible, or otherwise fill them with sandbags. (See Appendix D for details)

iii. Examine all drainage ditches on the landside of the levee and remove any obstructions. Be prepared to construct seepage drainage ditches, but not until actual seepage appears. Excavation of ditches near the levee or in the long berm area is hazardous and should not be undertaken except under direct supervision of the section leader and with the advice of the Corps of Engineer advisor assigned to that unit.

iv. Repair all levee settlement or depressions which have been worn down below levee grade. Materials to be used in filling holes and depressions should be obtained from distant sources (not adjacent to a levee system) unless it has been determined that borrowing in areas adjacent to the levee will not adversely affect its stability or the control of underseepage. Avoid taking material for these repairs from the area adjacent to the levee, particularly in the area of the seepage berm, except under direct supervision of the section leader and with the advice of the Corps of Engineer advisor. The fill material should be compacted and protected from wave wash and other erosion as necessary.

e. Other Phase 1 Activities

Once the initial inspection has been completed, each section leader should organize his labor force to perform the maintenance work as described in Appendix D of this manual. Additional activities to complete during Phase I are listed below:

i. Review assignments for patrols, closings, etc.
ii. Obtain lists of all construction equipment, motorboats, cars, earthmoving equipment and trucks that can be made available.
iii. Assess needed support (Vehicles, radios, etc).
iv. Verify serviceability of flood fighting equipment.
v. Record gage readings and monitor river stages.
vi. Close the levee to the public and remove cattle as necessary.
vii. Install levee or floodwall closures as necessary. (Remember to coordinate all road closings with the Department of Transportation or railroad authorities before limiting road or rail access through the levee!)
viii. Remove all dynamite and explosives from the vicinity of the levee.

4.2 Phase II: Full Response Activities

a. Continuing Activities

i. Patrol continuously, 24/7 (as the situation requires).
ii. Be sure all of the closures and gates are in place, and all maintenance is complete as described in Phase I, above.
iii. Completely remove padlocks from access gates to facilitate patrols.
iv. Monitor inventory of flood fighting equipment, materials and supplies as they are used.
v. Keep the public informed of the current situation through the media, if warranted.
vi. Repair any erosion and seepage problems identified by patrols as quickly as possible, as described in Appendix D of this manual.
vii. During flood periods, competent operators should be on duty whenever it appears that operation is imminent, even when station operation has been automated. Operators should thoroughly understand the manner in which the pumping station was designed to operate and be capable of manual operation should automated equipment or sensors fail.
viii. Portable pumps may be used to pump water over the levee, if water is ponding in undesirable areas or is rising too quickly in ponding areas. Ponding areas should be continually patrolled during high water.
ix. Monitor debris basins and trashracks for sediment and accumulated debris. As debris and sediment continue to be deposited in the basin, debris loads will substantially block racks, and sediment deposits will block the entrance to the basin, forcing the flow against the sides. Any large accumulation of debris on racks or flow directed on the sides of basins will cause local erosion and scour. Levees and concrete structures that are part of the debris basin facility will need to be closely monitored to ensure performance. Debris should be removed from trashracks at pumping stations periodically when the station is in operation.

b. Volunteer Assistance

If it becomes necessary to recruit volunteers during the flood fight, there are a number of steps that can be taken to organize their support.

i. Identify primary and alternate assembly areas, with adequate parking.
ii. Arrange transportation, subsistence, and shelter for the labor force as appropriate.
iii. Contact media to request that volunteers report to the designated assembly area, bringing flashlight, work gloves, rain gear, shovel, and a snack.
iv. Maintain sign-in roster at assembly area, to account for volunteers and personnel (name, home phone number, address, work group assignment).

v. Identify staging areas, away from the work site but as close to the flood fight locations as possible and with good access to clear roads. Separate areas in the staging site should be established for:

- sandbag filling
- carrying and loading
- materials stockpiles
- rest and breaks
- first aid

vi. Establish an emergency operations center to oversee the flood fight operations, and for interagency coordination. This operations center is to be manned 24 hours daily until the emergency is over. Consider equipping the EOC with:

- Radios and telephones for communication
- Television and/or radio to monitor weather and river forecasts
- Emergency generator in case of power outages
- Flashlights
- Administrative supplies
- Levee operations and maintenance manuals
- All emergency action plans
- Past flood reports/ after action reports
- State, county, and local maps; utility, flood plain, and levee maps
- Telephone books, phone rosters, and a directory listing numbers for the Army Corps of Engineers' Emergency Operation Center, railroad/ highway departments (needed when closing access), local contractors, the Red Cross, Salvation Army, hospitals, the police and fire departments, local and state Emergency Operations Centers, and other critical numbers

vii. Establish traffic patterns that will be used to move the sandbags from the staging area to the work site. If conditions permit, one-way traffic patterns should be established on the levee system if trucks are going to be used to transport the filled sandbags to the laying party.

viii. Be certain that the people laying sandbags are well supervised by a trained individual that knows how to properly lay the sandbags.

4.3 Evacuation Plans

You should be ready with a plan to evacuate the area. Consider the following points:

a. Immediately coordinate evacuation with police, fire department, and responders.
b. Remove sign-in roster and contact information from EOC, if possible.
c. Follow the predetermined plan for evacuation.
d. Meet in predetermined locations & immediately verify the safety of all personnel.

4.4 After the Event

Once the water has subsided and it isn't predicted to rise again, the area should be returned to the pre-flood condition.

a. Reopen any sluice gates that were closed, once the water on the river side has receded to 3 inches below the pond level on the protected side.
b. Open all closure structures and properly store all components.
c. All temporary protection measures (e.g. sandbags and material placed during temporary levee raises) must be removed and disposed of properly.
d. Take an inventory of all remaining flood fight equipment, sandbags, plastic, and other supplies. Repair or replace damaged equipment, and restock supplies such as sandbags or plastic in preparation for the next flood event.
e. Salvage any materials and supplies (e.g. wood from flashboards).
f. Return all borrowed equipment.
g. Identify whether remaining materials can be reused within the community.
h. Inspect the entire flood control work, noting locations of damage and the extent of damage at each location.
i. Coordinate potential rehabilitation with the Army Corps of Engineers.
j. Soon after the event, meet with key personnel, volunteer representatives, and community partners to debrief, share remaining concerns, and discuss lessons that were learned during the event.
k. Revise local emergency plans to account for lessons learned and changes to recommended procedures.
l. Document the event: keep a map record of the FCW, indicating areas that were in stress at the time of the flooding. This is useful for making repairs or improvements, and for use as a guide to focus attention on these areas during the next flood event.
m. For future planning, locate and keep records of the flood's high water marks; keep these records along with any rainfall and river data you may have gathered.
n. Make repairs to the FCW as soon as possible, in preparation for the next flood event.
o. Initiate actions to provide a permanent means of flood protection, if the existing system relies heavily on temporary solutions during emergencies.